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(54) Plant Hygiene Disinfectant

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Abstract

The invention relates to the use of a mixture consisting of

- A) a naturally occurring phenol compound selected from the group thymol, guaiacol, eugenol, carvacrol, salicylic acid or its salts, methyl salicylate, p-cumaric acid, caffeic acid, ferulic acid, sinapic acid, sinapic alcohol or mixtures thereof in an amount from 1 to 80% by weight, and
 - B) an aromatic alcohol selected from the group phenoxy-ethanol, phenethyl alcohol, benzyl alcohol, 2-phenoxypropan-1-ol, 1-phenoxypropan-2-ol, 3-phenoxypropan-1-ol, cinnamic alcohol, 2-phenylcyclohexanol or mixtures thereof in an amount from 20 to 99% by weight, in conjunction with
 - C) wetting agents, surfactants and customary additives in an amount of up to 1% by weight
- as a plant hygiene disinfectant.

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Plant hygiene disinfectant

The invention relates to the use of a plant hygiene disinfectant according to the above patent claims.

5 Plant hygiene disinfectants are subject to registration in the same way as are plant protection agents, and are used for controlling phytopathogenic fungi and bacteria as well as viruses in horticultural operations for regular and effective disinfection of selected
10 targets for the purpose of preventing economic damage.

 Plant hygiene disinfectants have hitherto contained as active components phenols, alcohols, aldehydes, quaternary ammonium compounds, amphoteric surfactants, active-oxygen compounds, heavy metals and halogens;
15 however, these are either insufficiently effective, for example alcohols, sodium hypochlorite and copper salts, or have weakened effectiveness at a higher degree of soiling, such as quaternary ammonium compounds. Because of inadequate compatibility with materials, active-
20 oxygen compounds and halogens are hardly used at all. Likewise aldehydes, for example glutaraldehyde and especially formaldehyde are unsuitable owing to increasing ecological and human toxicological considerations.

 The quaternary ammonium compounds used at present
25 are objected to by the registration authorities because of their uncertain decomposition characteristics in the soil; halogenated phenols such as p-chloro-m-cresol are environmentally objectionable.

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The object of the invention is to provide a disinfectant suitable for practical application which is effective even in the presence of organic and inorganic dirt, is reliable in use and is environmentally friendly, offers advantages as regards toxicity to humans and to the environment, and, finally, is compatible with plants, since in practice it comes into contact with the plant, for example, via spray water or by adsorption via the vapor phase.

Accordingly, this object is achieved by the use of a plant hygiene disinfectant as claimed in the main claim, preferred embodiments being outlined in the subclaims.

It has been shown that, surprisingly, a combination of

- A. a naturally occurring phenol compound, in particular thymol, and
- B. an aromatic alcohol, preferably phenoxyethanol, in conjunction with
- C. a wetting agent, preferably an alkyl benzenesulfonate

provides a preparation which meets very well the above requirements, the certain volatility of the active substance being advantageous for the effectiveness of the novel agent, since the active substances in the vapor phase penetrate the finest pores of the peat and substrate residues found in soiled areas. The excellent wetting action of the liquid disinfectants known hitherto is clearly insufficient to penetrate these areas; the low

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dirt compatibility of the non-volatile quaternary compounds lends support to this view.

5 The use according to the invention of these mixtures offers considerable advantages: the substances used as active substances are naturally occurring compounds which produce virtually no environmentally-damaging residues, are environmentally friendly and biologically degradable and in ready-for-use dilution constitute virtually no danger to plants, humans and animals. The active substances possess a volatility which is eminently suitable for disinfection in the field of plant hygiene; on the one hand they are not too volatile with the associated risk of rapid loss of active substances from the ready-for-use solution, but on the other hand they are volatile enough to provide effective action in the proximity of the application site via the vapor phase. Because of their good compatibility with plants, the risk of economic damage due to incorrect application, long-term action or spray contact is reduced.

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The mixture is furthermore in the form of a concentrate and in ready-for-use solution is virtually odorless or has a pleasant odor. The solution is chemically stable both as a concentrate and in ready-for-use dilution and has a high flash point of more than 100°C.

25

In addition, the combination of vegetable phenols such as thymol and aromatic alcohols such as phenoxy-ethanol is more effective than are the individual components and especially so in the presence of dirt; the

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combination is thus superior to the known formulations based on quaternary ammonium compounds and more economically viable on account of its good effectiveness and comparatively low application concentration.

5 The composition of the mixture usable according to the invention lies within the following weight ranges;

- | | | | |
|----|-------------------|---|---|
| A. | phenolic compound | 1 - 80%, preferably
5 - 40%, particularly
preferably 10 - 30% | |
| 10 | B. | aromatic alcohol | 20 - 99%, preferably
60 - 95%, particularly
preferably 70 - 90% |
| | C. | wetting agent or surfactant | 0.1 - 15%, preferably
1 - 10%, particularly
preferably 2 - 8% |

15

The phenolic compounds are preferred in the following order: thymol, guaiacol, eugenol, carvacrol, salicylic acid and its salts, methyl salicylate, p-cumaric acid, caffeic acid, ferulic acid, sinapic acid and finally also sinapic alcohol.

20

The aromatic alcohols are preferably used in the following order: phenoxyethanol, phenethyl alcohol, benzyl alcohol, 2-phenoxypropan-1-ol and 1-phenoxypropan-2-ol preferably as a mixture, 3-phenoxypropan-1-ol, cinnamyl alcohol and finally also 2-phenylcyclohexanol.

25

Suitable wetting agents or surfactants are anionic surfactants, non-anionic surfactants, quaternary ammonium compounds, amphoteric surfactants or mixtures thereof, alkyl benzenesulfonates, alkyl sulfates, alkyl

2012288

sulfonates, fatty alcohol ether sulfates or mixtures thereof being preferred.

5 The pH of the formulation according to the invention ranges from pH 1 to pH 12 and may be adjusted by an appropriate addition of chemicals. To reinforce the effectiveness, an acid pH range is advantageous, while to improve cleansing action the alkaline pH range is preferred.

10 The mixtures may also contain customary additives such as other known bactericidal and fungicidal active substances, corrosion inhibitors, dyes, odorants, stabilizers as well as alkalis, acids and buffer salts for adjusting or stabilizing the pH of the concentrate and/or of the ready-for-use solution, and additionally also
15 solvents, solubilizing agents, auxiliary substances for adjusting viscosity, plant nutrients or insecticides.

In addition to their wetting action, the surfactants also possess good dispersing and emulsifying action and have a beneficial effect on the stabilization of the
20 ready-for-use solution by counteracting tendency for separation and crystallization.

Example 1

25 To establish microbiological potency against phytopathogenic micro-organisms with or without loading, the formulations given below were prepared; of these, formulation A corresponds to the invention, while the comparison formulations B, C, D and E contain in each case one of the components required according to the

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Invention.

Formulations:

	A	B	C	D	E
5	<hr/>				
	2-Phenoxy-				
	ethanol	75	100		
	Thymol	20	20		20
	Ethanol		80	80	
	Marlon A 350	5			
10	NaOH, 45%				15
	H ₂ O			20	65

15 The microbiological potency of the formulations was tested according to the guidelines for the official testing of plant treatment agents, 16-4 guidelines for testing plant protection agents for disinfection of ornamental plants (issued by the Federal Biological Institute for Agriculture and Forestry, Berlin and Brunswick, April 1986); procedure according to Appendix 1, Laboratory Testing.

20 The results are listed in the attached Tables 1 to 4.

Table 1

without pest loading

Formulation	Concentration used (%)	Erwinia carotov.	Pseudomonas aeruginosa	Verticill. dahliae	Botrytis cinerea	Fusarium oxysporum	Thielav. basicola	Aspergillus niger
E (pH of 10 solution: 11.2)	3	120°	30°	120°	30°	240°	240°	> 240°
	2	240°	30°	240°	30°	> 240°	240°	> 240°
	1	240°	30°	240°	120°	> 240°	240°	> 240°
C	2	30°	120°	30°	30°	30°	30°	30°
	1	30°	120°	30°	30°	30°	30°	30°
	0.5	30°	240°	30°	30°	30°	30°	30°
D	2	240°	> 240°	> 240°	> 240°	> 240°	> 240°	> 240°
B	5	30°	30°	30°	30°	30°	30°	240°
	3	30°	30°	30°	30°	30°	30°	240°
	1	240°	> 240°	> 240°	> 240°	> 240°	> 240°	> 240°
A	1	30°	30°	30°	30°	30°	30°	30°
	0.5	30°	30°	30°	30°	30°	30°	30°

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Table 1

with 13 per cent loading

Formulation	Concentration used (%)	Erwinia carotov.	Pseudomonas aeruginosa	Verticill. dahliae	Botrytis cinerea	Fusarium oxysporum	Thielav. basicola	Aspergillus niger
E (pH of 14 solution: 11.2)	3	60°	30°	30°	30°	30°	30°	120°
	2	60°	30°	30°	30°	60°	30°	120°
	1	60°	30°	60°	30°	60°	30°	120°
C	2	30°	240°	30°	30°	30°	30°	60°
	1	30°	240°	30°	30°	30°	30°	120°
	0.5	> 240°	> 240°	30°	30°	30°	30°	> 240°
D	2	> 240°	> 240°	> 240°	> 240°	> 240°	> 240°	> 240°
B	5	30°	30°	30°	30°	30°	30°	240°
	3	30°	30°	30°	30°	30°	30°	240°
	1	> 240°	> 240°	> 240°	120°	> 240°	> 240°	> 240°
A	1	30°	30°	30°	30°	30°	30°	30°
	0.5	30°	30°	30°	30°	30°	30°	30°

2012288

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Table 2

without pest loading

Formulation	Concentration used (%)	Ervinia carotov.	Pseudomonas aeruginosa	Verticill. dahliae	Botrytis cinerea	Fusarium oxysporum	Thielav. basicola	Aspergillus niger
Commercial preparation based on quaternary compounds (pH 5.5)	2	30°	30°	30°	30°	30°	30°	30°
	1	30°	30°	30°	30°	30°	30°	30°
	0.5	30°	30°	30°	30°	30°	30°	30°
10 Thymol 50 Quercetin 210 Cl. 50°	3	30°	30°	30°	30°	30°	30°	60°
	2	30°	30°	30°	30°	30°	30°	60°
	1	30°	240°	30°	30°	30°	30°	120°
30 Phenol-eth. 10 Solventon PH								

1 50% didcylidimethylammonium chloride solution

2 1-methoxypropan-2-ol

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Table 4

with 1% part loading

Formulation	Concentration used (%)	Erwinia carotov.	Pseudomonas aeruginosa	Verticill. dahliae	Botrytis cinerea	Fusarium oxysporum	Thielav. basicola	Aspergillus niger
Commercial preparation based on quaternary compounds (pH 5.5)	2	> 240°	120°	30°	30°	30°	30°	30°
	1	> 240°	120°	30°	30°	30°	30°	30°
	0.5	> 240°	> 240°	30°	30°	30°	30°	> 240°
10 Ibuprofen 50 Quercetin 210 CL 501 30 Phenacyl- eth. 10 Solventon PH	3	240°	240°	30°	30°	30°	30°	> 240°
	2	240°	> 240°	120°	30°	30°	30°	> 240°
	1	> 240°	> 240°	> 240°	30°	> 240°	30°	> 240°

1 50% didacyldimethylammonium chloride solution

2 1-methoxypropan-2-ol

2012288

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The results show that the combination phenoxy-ethanol + thymol (mixture A) is more effective than the individual components. The combination is a clear, colorless liquid with a weak, characteristic, pleasant odor.

The 0.5, 1 and 2% ready-for-use solution in water is highly compatible with plants both in the soil and in the vapor phase. The 0.5 to 2% ready-for-use solutions in water are colorless, virtually clear to faintly milky, have a neutral pH and are slightly foaming. The ready-for-use solution is an effective cleaning agent, is comparatively well tolerated by skin, is heat stable and resistant to light.

Determination of oxygen consumption of cultivated sewage sludge by the Warburg method (German standard methods for water, effluent and sludge investigation; L 2 and H 5, 1972) established that a 0.1% solution of formulation A is toxicologically harmless to sewage sludge.

The BOD₅ value, determined from the difference between test solution and control, is 1.110 mg of O₂/liter for the 0.01% solution of formula A, i.e. the 0.01% solution acts as a substrate for the flora of the sewage sludge and is oxidatively degraded.

The mixture used according to the invention is useful for controlling all important phytopathogenic micro-organisms, such as *Xanthomonas perlargonii* and *begoniae* (oil spots on pelargoniums and begonias), *Erwinia amylovora* (fire blight), *Erwinia carotovora*

(saintpaulias), *Erwinia chrysanthemi* (pot chrysanthemums), *Botrytis cinerea*, *Phytophthora*, *Pythium*, *Thielaviopsis basicola*, (cyclamen, poinsettias, begonias), *Verticillium dahliae* (pelargoniums, begonias), *Cylindrocladium scoparium* (ericas and azaleas), *Cylindrocladium parvum*, *Plasmodiophora brassicae* (club root); long-lived organisms such as *Botrytis sclerotia* and *chlamydozpora*, *Thielaviopsis* and *Fusarium* are killed. Furthermore, *Aspergillus niger* (mold), moss and algae are attacked.

The mixtures are employed in horticulture especially after preliminary cleaning treatment against bacterial, fungal and viral phytopathogenic germs on display surfaces, beet trough walls, cultivation vessels such as pots, plates or seed trays, greenhouse interior surfaces, potting tables, substrate storage surfaces, container stores, surfaces and installations in store rooms for plants and plant products, and on equipment such as transport boxes, service trolleys, wheelbarrows, shovels and plant dibbers.

20 Example 2

Mixtures consisting of 75% by weight of phenoxy-ethanol and 5% by weight of alkyl benzenesulfonate (Marlon A 350-(Wz)-) with other naturally occurring phenols were prepared in amounts of 20% by weight in each case as follows:

Formulation F:	with guaiacol
Formulation G:	with eugenol
Formulation H:	with chlorothymol

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Table 5

Formulation	Concen- tration used (%)	Pseudomonas aeruginosa	Erwinia carotov.	Aspergillus niger	Verticill- ium	Botrytis cinerea	Fusarium oxysporum	Thiele- viopsis
P	0.5%	> 240'	> 240'	> 240'	60'	15'	> 240'	15'
	1.0%	240'	30'	240'	30'	15'	240'	15'
	2.0%	15'	15'	> 240'	15'	15'	30'	15'
	5.0%	15'	15'	30'	15'	15'	15'	15'
C	0.5%	> 240'	15'	240'	15'	15'	> 240'	15'
	1.0%	> 240'	15'	> 240'	15'	15'	30'	15'
	2.0%	15'	15'	> 240'	15'	15'	15'	15'
	5.0%	15'	15'	> 240'	15'	15'	15'	15'
H	0.5%	> 240'	15'	15'	15'	15'	15'	15'
	1.0%	240'	15'	15'	15'	15'	15'	15'
	2.0%	15'	15'	15'	15'	15'	15'	15'
	5.0%	15'	15'	15'	15'	15'	15'	15'

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Patent Claims

1. Use of a mixture consisting of
 - A) a naturally occurring phenol compound selected from the group thymol, guaiacol, eugenol, carvacrol, salicylic acid or its salts, methyl salicylate, p-cumaric acid, caffeic acid, ferulic acid, sinapic acid, sinapic alcohol or mixtures thereof in an amount from 1 to 80% by weight, and
 - B) an aromatic alcohol selected from the group phenoxy-ethanol, phenethyl alcohol, benzyl alcohol, 2-phenoxypropan-1-ol, 1-phenoxypropan-2-ol, 3-phenoxypropan-1-ol, cinnamic alcohol, 2-phenylcyclohexanol or mixtures thereof in an amount from 20 to 99% by weight, in conjunction with
 - C) wetting agents, surfactants and customary additives in an amount of up to 15% by weightas a plant hygiene disinfectant.
2. Use of a mixture as claimed in claim 1 consisting of 5 to 40% by weight of the naturally occurring phenol compounds, 60 to 95% by weight of the aromatic alcohols and 1 to 10% by weight of wetting agents, surfactants or customary additives.
3. Use of a mixture as claimed in claim 1 consisting of 10 to 30% by weight of the naturally occurring phenol compounds, 70 to 90% by weight of the aromatic alcohols and 2 to 8% by weight of wetting agents, surfactants or customary additives.
4. Use of a mixture as claimed in claims 1 to 3 in an application concentration of up to 5%.

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